

tinued in its present polytechnic form. Another recommendation accepted states, among other points, that, in the event of its proving impossible to secure the continuance of the Goldsmiths' Institute as a polytechnic, the council would regard it as of great importance to secure its retention as a centre of evening instruction in as many subjects as possible, especially in the higher grades, and to arrange for the continuance of an efficient department of mechanical and electrical engineering for evening students.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 9.—"The Fossil Flora of the Culm Measures of North-west Devon, and the Palæobotanical Evidence with regard to the Age of the Beds." By E. A. Newell **Arber**. Communicated by Prof. McKenny Hughes, F.R.S.

The Carboniferous rocks of Devonshire, generally known as the Culm Measures, are divided into an Upper and a Lower division. The Upper Culm Measures, which are of Upper Carboniferous age, form by far the thickest portion of this Carboniferous series. Plant remains, although abundant in these beds, are rarely sufficiently well preserved to admit of identification. A number of species have, however, been obtained, some of which are new to Britain, from the one horizon in the Upper Culm Measures in which coal, known locally as culm, is found. This flora is identical with that of the Middle Coal Measures elsewhere in England, and consequently the horizon on which the coal or culm occurs in the Bideford district is the equivalent of the Middle Coal Measures, a higher horizon than has been previously assigned to these beds.

There is also evidence that the Culm Measures at Instow, which occupy a lower horizon than the Culm Measures of the Bideford district, are probably the equivalents of the Lower Coal Measures. Thus both the Lower and Middle Coal Measures are represented in Devonshire, and, as the higher beds of the Culm Measures are as yet unexplored, possibly even higher horizons may eventually be found to be represented.

It is pointed out that the Culm Measures of Devon, which have been regarded by several geologists as essentially a Lower Carboniferous formation, are in reality chiefly, but not entirely, of Upper Carboniferous age. Consequently, the term "culm" or "kulum" generally applied to certain deposits in Germany, Austria, and elsewhere on the Continent, which are entirely of Lower Carboniferous age, is peculiarly unfortunate, for these beds are not of the same age as the great bulk of the Devonshire Culm Measures.

June 16.—"The Decomposition of Ammonia by Heat." By Dr. E. P. **Perman** and G. A. S. **Atkinson**.

Ammonia gas was heated in a porcelain globe placed in a muffle furnace, and the total pressure of the ammonia and decomposition products was read by means of a mercury manometer at equal time intervals, the volume being kept constant. The temperature was measured by a Callendar-Griffiths pyrometer, and was maintained constant within 1° or 2° ; in the various experiments it varied from 677° to 1111° .

At the end of each experiment the temperature was raised to about 1100° , and maintained at that point until the decomposition of the ammonia was practically complete; the pressure was then read again, and from it was calculated the initial pressure of the ammonia in the globe.

Let p_1 be the pressure of the ammonia at any instant during the decomposition, p_1' that of the nitrogen, p_2' that of the hydrogen, P the total pressure at the same instant, p_0 the initial pressure of the ammonia, then $p_1 + p_1' + p_2' = P$, $p_2' = 3p_1'$, and $p_1 + p_2' = 2(p_0 - p_1)$; from these equations it follows by substitution that $p_1 = 2p_0 - P$, i.e. the pressure of the ammonia at any instant is double the initial pressure minus the total pressure at the instant of observation. The experimental data furnish values of P and $2p_0$, and values of $2p_0 - P$ have been calculated and tabulated; from the latter were calculated $\Delta P/\Delta t$; but $\Delta P/\Delta t = dP/dt$ approximately, and $dP/dt = dp_1/dt$, so that the rate of change of pressure of the ammonia at various pressures becomes known. Two

series of curves have been drawn, showing the variation of the rate with the pressure. The most noteworthy features of the curves are:—(1) at the highest temperatures they become straight lines; (2) they all run towards the origin; (3) they become much steeper when certain metals (mercury, iron, or platinum) are present in the globe. The chief deductions are:—(1) the decomposition is monomolecular; (2) and (practically if not completely) irreversible; (3) the rate of decomposition is much increased by the presence of certain metals.

Some experiments were made also on the effect of sudden change of pressure on the rate of decomposition; the results confirmed the conclusion that the reaction is monomolecular. The irreversibility of the reaction was confirmed by passing nitrogen and hydrogen through a red-hot glass tube containing porcelain, when no ammonia was found to be produced.

Royal Astronomical Society, June 10.—Prof. H. H. Turner, president, in the chair.—Mr. A. R. **Hinks** read a paper on the reduction of 295 photographs of Eros made at nine observatories during the period 1902 November 7–15, with a determination of the solar parallax; 110 of the plates were taken at Cambridge, the remainder at Algiers, Lick Observatory, Northfield Observatory, Oxford, Paris, and other observatories. The author described the method employed in the reductions, &c., and gave as the resulting value for the solar parallax $8''.7966 \pm 0''.0047$, a result nearly in accordance with that obtained by Sir D. Gill from heliometer observations of minor planets.—Mr. M. E. J. **Gheury** read a paper on the gyroscopic collimator of Admiral Fleuriat. In this instrument the principle of the gyroscope was employed to furnish an artificial horizon for sextant observations at sea. The instrument was shown to the meeting, and its construction and method of employment were described.—Mr. Bryan **Cookson** gave an account of his paper on the mass of Jupiter, and corrections to the elements of the orbits of the satellites, from heliometer observations made at the Cape Observatory during the years 1901 and 1902. The methods of observation and reduction were explained, and a brief account given of the results.—Mr. E. W. **Maunder** read a paper on the distribution of sun-spots in heliographic latitude during the years 1874 to 1902. The author considered Spoerer's law for the distribution of sun-spots to be true within the limits of its enunciation—that there is only one spot zone in either hemisphere except during the brief period just after minimum.—The Rev. A. L. **Cortie** read a paper on the variation of latitude of the greater sun-spot disturbances, 1881–1903. Dr. Lockyer briefly replied, contesting some of Mr. Maunder's conclusions.

Chemical Society, June 15.—Prof. W. A. Tilden, F.R.S., president, in the chair.—The following papers were read:—The mechanical analysis of soils and the composition of the fractions resulting therefrom: A. D. **Hall**. The object of the investigation was to ascertain the effect of introducing into the mechanical analysis of soils a preliminary treatment of the soil in dilute acid followed by ammonia, as first suggested by Schlesing. Eighteen soils of known history were selected from the Rothamsted experimental plots, to give comparisons of the same soil in an unmanured condition and when rich in humus through the accumulation of organic matter. With these soils the method involving a preliminary treatment with acid showed the essential identity of soils from the same experimental field whatever the manuring had been, whereas the analyses made on the raw soil gave very different results, depending on the treatment the various plots had received.—The effect of the long-continued use of sodium nitrate on the constitution of the soil: A. D. **Hall**. On reviewing the results of the mechanical analysis of the Rothamsted soils, it was observed that those which had been manured with sodium nitrate every year gave abnormal results for the last fraction. The removal of the finest particles from the surface soil is attributed to deflocculation induced by the use of sodium nitrate, and followed by the washing of the finest particles into the subsoil.—The decomposition of oxalates by heat: A. **Scott**. It is shown that the decomposition of oxalates by heat is less simple than is generally supposed, and that, except in the case of magnesium oxalate, the oxalates of the common metals generally yield a small

quantity of carbon.—Some alkyl derivatives of sulphur, selenium and tellurium: A. G. **Perkin**. A description of the derivatives obtained by the action of various alkyl iodides on these elements.—The ultra-violet absorption spectra of certain *enol-keto*-tautomerides, part i., acetylacetone and ethyl acetoacetate: E. C. C. **Baly** and C. H. **Desch**. From comparative observations of the absorption spectra of these compounds under various conditions, the conclusion is drawn that with acetylacetone, ethyl acetoacetate, and their metallic derivatives, a state of dynamic isomerism exists in the solutions, and that this isomerism is evidenced by a characteristic band in the spectra.—The action of acetyl chloride on the sodium salt of diacetylacetone and the constitution of pyrone compounds: J. N. **Collie**. A description of three isomerides obtained in this reaction, from the study of which the author has been led to assign a new constitution to pyrone and its derivatives.—Our present knowledge of the chemistry of indigo: W. P. **Bloxam**. Some observations on the purity of commercial indigotin and on the composition of indirubin were made.— $\Delta^{1:3}$. Dihydrobenzene: A. W. **Crossley**. A description of the formation and properties of this substance is given.—The absorption spectrum of *p*-nitrosodimethylaniline: W. N. **Hartley**. The absorption caused by *p*-nitrosodimethylaniline at the less refrangible end extends into the infra-red, and at the more refrangible far into the ultra-violet. The transmitted rays are thus restricted to a band of yellow and green light bordered on either side by a band of intense absorption. The alkyl-substituted phenols and anilines absorb varying quantities of the ultra-violet, the absorption not extending into the visible spectrum; but it is also shown that the introduction of the NO, as distinguished from the NOH group, extends the absorption far into the coloured rays.—The influence of solvents on the rotation of optically active compounds, part vi., the relationship between solution-volume and rotation of the dialkyl and potassium alkyl tartrates in aqueous solution: T. S. **Patterson**.—The constitution of hydrastinine: J. J. **Dobbie** and C. K. **Tinkler**. Solutions of hydrastinine in ether or chloroform are colourless, and their absorption spectra are practically identical with the spectra of hydrohydrastinine. From this it is argued that the carbinol formula should be preferred to the open-chain or aldehydic formula of Roser. On the other hand, the aqueous or alcoholic solutions of hydrastinine give spectra which agree with those of the hydrastinine salts, whence it would appear that, under the influence of these solvents, hydrastinine changes from the carbinol to the ammonium base.—The influence of moist alcohol and ethyl chloride on the boiling point of chloroform: J. **Wade** and H. **Finnemore**. Chloroform made from alcohol contains, in addition to alcohol, a small quantity of ethyl chloride, both of which depress the boiling point.—Limonene nitrosocyanides: W. A. **Tilden** and F. P. **Leach**. The nitrosocyanide described by Tilden and Burrows as a liquid is found to be a crystalline optically active solid having m.p. 90–91°, and $[\alpha]_D + 165^\circ$.—Photochemically active chlorine, ii., a preliminary notice: C. H. **Burgess** and D. L. **Chapman**.—Additive compounds of anhydrous magnesium bromide with organic oxygen and nitrogen compounds: J. J. **Sudborough**, H. **Hibbert**, and S. H. **Beard**.—Differentiation of primary, secondary, and tertiary amines. A preliminary note: J. J. **Sudborough** and H. **Hibbert**.—Influence of radium radiations on labile stereoisomerides: J. J. **Sudborough**. The results indicate that *allo*-cinnamic acid and its α and β bromo-derivatives are transformed more readily under the influence of sunlight than by prolonged exposure to radium radiations.—Notes on analytical chemistry: G. T. **Morgan**. The separation of arsenic by distillation in hydrogen chloride. The estimation of carbon by oxidation with chromic acid.—Nitrogen chlorides containing two halogen atoms attached to the nitrogen: F. D. **Chattaway**.—Sulphonphenylchloroamides and sulphonolylchloroamides: F. D. **Chattaway**.—Stereoisomeric glucoses and the hydrolysis of glucosidic acetates: E. F. **Armstrong** and P. S. **Arup**. It was shown that the acetyl groups are removed with unequal readiness from the penta-acetates of glucose and galactose and from sucrose octaacetate, and with equal readiness from the tetra-acetates of the methyl-glucosides and galactosides.—The colouring matter of the

flowers of *Butea frondosa*: A. G. **Perkin**. This dye-stuff is shown to contain two substances, *butin* and *butein*, which are closely related in constitution, the former being a chalcone compound and the latter the corresponding flavonone isomeride.—Cyanomaclurin: A. G. **Perkin**. This product, which exists in jackwood, closely resembles the catechins in constitution, and is probably derived from them by the replacement of a catechol nucleus by resorcinol.—The determination of acetyl groups: A. G. **Perkin**. A description of a hydrolytic method of estimating acetyl groups in organic compounds.—Note on the catechins: A. G. **Perkin**. A description of the acetyl derivative of the catechin (*acacatechin*) derived from *Acacia catechu* is given.—A constituent of Java indigo: A. G. **Perkin**. It is shown that the yellow colouring matter present in Java indigo is identical with kampherol.

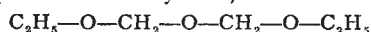
Royal Microscopical Society, June 15.—Dr. D. H. Scott, F.R.S., president, in the chair.—A direct proof of Abbe's theorems on the microscopic resolution of gratings: Prof. J. D. **Everett**. The image of the grating formed by the objective is the resultant effect of the disturbances in the image plane due to the diffraction spectra formed in the focal plane. The optical path measured from a plane wave-front, before incidence on the grating, to the spectrum of order o , is unaffected by displacement of the grating. The path to a spectrum of order i is altered by $\lambda x/s$, and to a spectrum of order n by $n\lambda x/s$, by a shift x of the grating, s denoting the distance between rulings. At a fixed point P in the image plane, the interference of the spectrum of order o with a spectrum of order n goes through a complete cycle, while x increases by s/n . That is, n lines in the image move across P during a displacement s of the grating. Similar reasoning applies to the interference of any two of the spectra, and gives Abbe's results. A displacement x towards either side diminishes the paths to the spectra on this side, and increases the paths to the spectra on the other side. When only one spectrum operates, there is no interference and no alternation of brightness.—The recent Foraminifera of the Malay Archipelago: F. W. **Millett**.—Nature's protection of insect life: F. **Enock**.

Physical Society, June 24.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—Chemical dissociation and electrical conductivity: A. E. **Garrett** and Dr. R. S. **Willows**. It has been shown by Beattie (*Phil. Mag.*, 1899) that a mixture of salt and iodine, when placed on a zinc plate and heated, gives rise to electrical conductivity, although separately no such effect is produced. This is shown to be due to the formation of zinc iodide. Following on this the electrical conductivity produced by heating various salts is investigated under different conditions of temperature and electric field. A large excess of positive electricity is found in nearly every case.—The magnetisation of iron in bulk: Dr. W. M. **Thornton**. The paper is in three sections. The first describes a method of measuring large quantities of magnetism by the use of an exploring coil placed around the core and an exciting coil in series with a recording milli-voltmeter. The second section deals with the curves of rise of magnetising currents, when the core is solid and when laminated, as affected by the reaction of the core-currents, and also by the change of permeability during magnetisation. In the last section an example is given of the sudden dip in the curve of rise observed only with large cores.

PARIS.

Academy of Sciences, June 27.—M. Mascart in the chair.—Researches on cyanogen: solubility and polymerisation: M. **Berthelot**. There is no true coefficient of solubility of cyanogen in water or alcohol, a slow chemical reaction taking place from the first. With other solvents, such as acetic acid, turpentine, chloroform, and benzene, the ordinary laws of solution are obeyed.—Researches on cyanogen and on its reaction with potassium cyanide: M. **Berthelot**. An attempt to prepare polycyanides corresponding to the triiodides was not successful. Cyanogen is rapidly absorbed by a solution of potassium cyanide, but no compound corresponding to potassium triiodide was obtained, the gas being partly hydrolysed and partly polymerised.—On the distribution of time at a distance by means of wireless telegraphy: G. **Bigourdan**. The experiments described have been successful up to a distance of 2 kilo-

metres, and there seems no reason to suppose that the signals could not be easily sent over much longer distances.—On the distillation of a mixture of two metals: **Henri Moissan** and **M. O'Farrelley**. Alloys of copper, lead, zinc, cadmium, and tin were heated in carbon boats in the electric furnace. The alloys behaved exactly as in an ordinary fractional distillation, the composition varying with the time of distillation and the quantity of metal distilled. Thus with alloys of zinc and copper, cadmium and copper, lead and copper, a residue could be obtained after a certain time consisting of pure copper.—The influence on the rotatory power of certain molecules exerted by non-saturated radicals. The allyl ethers of borneol, menthol, methylcyclohexanol, and linalool: **A. Haller** and **F. March**. With one exception, the ethers possess a higher rotatory power than the active alcohols from which they are derived. With the same exception, the molecular refractive powers found are in accord with those calculated.—Muscular work and the expenditure of energy in dynamic contraction: **A. Chauveau**.—Improvements in the photographic method for recording the action of the n -rays on a small electric spark: **R. Blondlot**. The improvements on the method previously described include the use of an aluminium lens for concentrating the rays from the Nernst lamp on the spark gap, together with some details necessary for the working of the spark. Very slow development of the negative is required to bring out the effect clearly.—The action of magnetic and electric forces on ponderable emission; the effect of air in motion on this emanation: **R. Blondlot**.—**M. Maquenne** was elected a member of the section of rural economy in the place of the late **M. Duclaux**, and **Prof. Waldmeyer** a correspondant in the section of anatomy and zoology in the place of **Prof. A. Agassiz**, elected foreign associate.—On certain classes of isothermal surfaces: **L. Raffy**.—On a class of partial differential equations of the second order: **J. Clairin**.—Remarks on the propagation of percussions in gases: **E. Jouguet**.—On a new aerial helix: **H. Hervé** and **H. de la Vaulx**.—The dielectric cohesion of the saturated vapour of mercury and its mixtures: **E. Bouty**. The experiments were made in a fused silica flask, which satisfied the necessary condition of possessing no conductivity at the temperature of the experiment. The cohesion of mercury vapour is only 0.85 that of air, which, having regard to the high density of the vapour, is remarkably small. The effect of introducing various gases with the mercury vapour was also studied.—The transport of ultramicroscopic particles in the current: **A. Cotton** and **H. Mouton**.—On a new method of three-colour photography: **R. W. Wood**.—On the yellow and red varieties of thallium iodide and the determination of the normal point of their reciprocal transformation: **D. Gornex**. The transition point was determined as 168° , or 22° lower than the figure usually accepted.—On the nitrate and nitrite of thallium: **U. Thomas**. Thallous nitrate is decomposed at 450° , furnishing nitrous anhydride and a well crystallised sesquioxide, without any appreciable amount of nitrite being formed. The nitrite is decomposed in an analogous manner. It was found that thallous nitrate can be partly volatilised without decomposition.—The total synthesis of rhodinol, the characteristic alcohol of essence of roses: **L. Bouveault** and **M. Gourmand**. Ethyl geraniate, treated with sodium and absolute alcohol, gives a mixture of two alcohols, one of which is rhodinol. This alcohol possesses a strong odour of roses, and, except that it is inactive, shows all the properties of the rhodinol extracted from essence of roses and essence of pelargonium. A crystalline semicarbazone, melting at 112° , has been prepared from its pyruvate, and this has been found to be identical with the similar compound prepared from the natural rhodinol.—On two homologues of pyrocatechol: **R. Delange**. The preparation of ethylpyrocatechol and isopropylpyrocatechol is described, and their physical properties given.—On a new class of ether-oxides: **Marcel Descudé**. By the action of sodium ethylate upon dichloromethylether, the ether



is obtained. In its chemical and physical properties it approximates to the formals.—On methylarsenic: **V. Auger**. Solutions of sodium methylarsenate reduced by heating in the water bath with sodium hypophosphite give a yellow

oil of the empirical composition CH_3As . This can be purified by fractional distillation in a vacuum, and cryoscopic determinations in benzene solution show that its molecular weight is four times that of the simple formula. It polymerises readily in presence of hydrochloric acid, giving a brown powder which has been mistaken for arsenic.—On some mixed phosphorus acids derived from hypophosphorous acid: **C. Marie**.—Additional ammoniacal compounds of the rosanilines: **Jules Schmidlin**.—Study of the variation of the mineral matters during the ripening of seeds: **G. André**.—Researches on plant acidity: **Eug. Charabot** and **Alex. Hébert**.—The action of heat and acidity on dissolved amylase: **P. Petit**. The diastatic power of a malt may be increased by altering the acidity of the solution to the point corresponding to coagulation by heat.—Abnormal developments independent of the medium: **C. Viguié**.—On an unknown animal met with in the Bay of Along: **M. L'Eost**. An account of an animal, apparently a sea serpent, seen from the gunboat *Décidée* on February 25. Its length was estimated at 30 metres.—The complete extraction of water and gases from seeds: **Paul Becquerel**.—A resonance method for the determination of the frequency of nervous oscillations: **Augustin Charpentier**.—On the urinary chromogen due to subcutaneous injections of skatol: **Ch. Porcher** and **Ch. Hervieux**.—The action of salts of the alkaline metals upon the living substance: **N. C. Paulesco**. The limiting quantities of salts of the alkalies which act upon yeast under fixed conditions are proportional to their molecular weights.—On the problem of "statical work": hydrodynamical and electrodynamical paradoxes: **Ernest Solvay**.—On the laws of the so-called "statical work" of muscle: **Ch. Henry**.—On the toxic action of intestinal worms: **L. Jammes** and **H. Mandoul**.—Observations at the Franco-Scandinavian captive balloon station at Hald: **L. Teisserenc de Bort**.

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